

Appl. No. 10/823,034
Reply to Office Action of July 26, 2005

REMARKS/ARGUMENTS

The subject matter of claim 5 is combined into claim 1 and the subject matter of claim 10 is combined into claim 8. In addition, claims 1 and 8 (as amended) are supported by description on page 11, lines 10-14 and page 25, lines 1-6 of the Specification.

There were no art related rejections of claims 5 and 10. Therefore, introducing their limitation into the main claims avoid the art rejection. However, claims 5 and 10 are rejected under 35 U.S.C. 112. The Examiner states in paragraph 2 of the Office Action:

"Regarding Claims 5 and 10, 'wherein the rear surface of the fixed printing plate material has a smoother value of not more than 0.06 MPa, and a coefficient of static friction of the rear surface to the fixing member is from .3 to .6.' Applicant claims a specific 'smoother value' for the printing plate material. The disclosure merely sets forth that the smoother value is 'a physical value described in the J. Tappi paper pulp test No. 5.' And that the value is obtained from a 'smoother SM-6B.' Such disclosure does not set forth how to test for or create a material satisfying the claimed range."

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Applicants respectfully disagree with the Examiner's limited interpretation of the disclosure as restricted to the excerpt noted above, as to how to measure the smoother value.

Attention is directed to the additional and detailed description on page 25, line 9 to page 26, line 4 of the Specification which describes the measurement in terms easily understood by persons working in this field. One of ordinary skill in the art would easily understand the meaning of the terms from the description. However, for easier comprehension, applicants would like to explain in more detail how to measure the smoother value.

A measuring head of the smoother SM-6B has a cylindrical measuring head equipped with, a suction device for evacuating air in the head, in which one of the two bases is open and the other is closed. Before measurement, a printing plate material sample to be measured is subjected to conditioning at 23°C and 60% RH (relative humidity) for 2 hours. The measuring head is put on the surface of the resulting sample to be measured, so that the opened base faces the sample surface. After that, air in the measuring head is evacuated through the suction device to obtain air pressure P (in terms of MPa) in the head in the stationary, which is defined as a smoother value.

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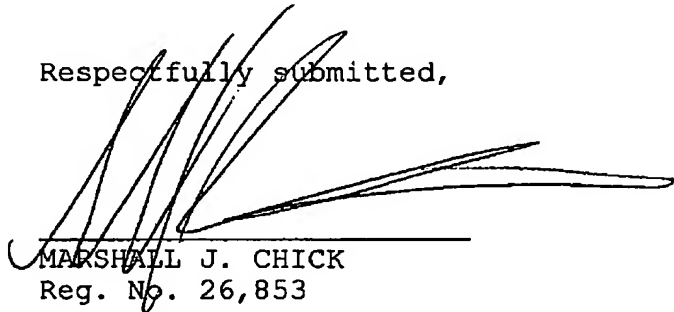
It is also submitted that the term "smoother value" is well-known to one of ordinary skill in the art.

The term "smoother value" is described in, for example, US 2003/0035935A1 (see page 17, paragraph [0289]) and USP 5,856,060 (see column 11, lines 65-67). Relevant portions thereof are enclosed herewith.

In view of the above it is submitted that the claims are patentable over the art and meet the requirements of 35 USC 112. Entry of this AMENDMENT and allowance of the application are respectfully requested.

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Enclosure: Copy of page 17 of US 2003/0035935A1 and
column 11 of USP 5,856,060

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ethyl cellulose adsorbing a volatile compound such as water and polymers of natural origin such as gelatin adsorbing a volatile compound such as water. Examples of the low molecular weight compound generating a gaseous material by the decomposition or denaturation caused by heat include diazo and azide compounds. These compounds decompose exothermically and generate gaseous compounds.

[0284] The decomposition or denaturation of such heat-sensitive materials promoted by heat preferably proceeds at temperatures not exceeding 280° C., more preferably not exceeding 230° C.

[0285] In cases where a low molecular weight compound is used as the heat-sensitive material for the heat-sensitive releasing layer, a binder is preferably jointly used with the compound. As such a binder, a heat-sensitive polymer capable of generating a gas upon thermal decomposition or denaturation may be employed, but ordinary polymers not exhibiting such thermal response may be also employed. In cases where a heat-sensitive compound and a binder are jointly used, the mass ratio therebetween is preferably 0.02:1 to 3:1, more preferably 0.05:1 to 2:1. The heat-sensitive releasing layer preferably covers substantially the entire surface of the light-to-heat conversion layer, and the thickness is usually 0.03 to 1 μm , preferably 0.05 to 0.5 μm .

[0286] In the thermal transfer sheet comprising a substrate and provided thereon a light-to-heat conversion layer, a heat-sensitive releasing layer and an image-forming layer in this order, the heat-sensitive releasing layer undergoes decomposition or denaturation by the heat conducted from the conversion layer to generate a gas. By the decomposition or the gas generation, part of the heat-sensitive releasing layer disappears, or a cohesive destruction occurs in the releasing layer, thus weakening the bonding between the conversion layer and the image-forming layer. Therefore, in some cases, part of the releasing layer may adversely adhere to the image-forming layer, and appear on the surface of the finally obtained image, acting as a cause of color contamination in the image. In taking into account such possibility, the heat-sensitive releasing layer should preferably be substantially colorless, i.e., transparent to the visible light to prevent visually recognizable color contamination in the final image. Specifically, the light absorption of the heat-sensitive releasing layer should not exceed 50% or preferably 10% for the visible light.

[0287] Instead of providing an independent heat-sensitive releasing layer in the thermal transfer sheet, a layer acting as both of the conversion layer and the releasing layer may be provided by using a coating mixture for the light-to-heat conversion layer containing a heat-sensitive material cited hereinabove.

[0288] The static frictional coefficient of the outermost layer of the thermal transfer sheet at the side where the image-forming layer is provided is preferably adjusted to 0.35 or lower, more preferably 0.20 or lower. By making the static frictional coefficient of the outermost layer not larger than 0.35, the thermal transfer sheet is not contaminated during conveyance with rolls, thus securing high image quality. The static frictional coefficient can be measured by the method described in paragraph [0011] of Japanese Patent Application No. 2000-85759.

[0289] The Smooter value of the image-forming layer surface preferably lies in the range of 0.5 to 50 mm Hg

(≈ 0.0665 to 6.65 kPa ("a" means "about")) at 23° C., 55% RH, and Ra thereof in the range of 0.05 to 0.4 μm . With these surface properties, the number of the minute voids is favorably suppressed that are present in the contact plane between the image-forming and image-receiving layers and where the two layers cannot directly contact, since a preferable transfer condition is secured for achieving high quality images. The value of Ra is measured with a surface roughness meter (Surfcom, a product of Tokyo Seimitsu Co., Ltd.). As for electrostatic property, the image-forming layer should preferably exhibit a potential of -100 to 100 V when the thermal transfer sheet is charged according to the US Federal Government Test Standard 4046, then grounded and left for 1 sec. The surface resistance of the image-forming layer should not exceed $10^9 \Omega$ at 23° C., 55% RH.

[0290] The image-receiving sheet used in combination with the thermal transfer sheet will be described.

[0291] [Image-receiving Sheet]

[0292] (Layer Structure)

[0293] The image-receiving sheet usually comprises a substrate and provided thereon one or more image-receiving layers, and if required, one or two layers selected from cushion and releasing layers and an inter-layer between the substrate and the image-receiving layer. The conveyance property is preferably improved by providing a back coating on the side of the substrate opposite to the image-receiving side.

[0294] (Substrate)

[0295] As the substrate, usual sheet-formed materials may be used including plastic, metal and glass sheets, resin-coated paper, paper and various composite materials. Suitable plastic sheets include those made of, for example, poly(ethylene terephthalate), polycarbonate, polyethylene, poly(vinyl chloride), poly(vinylidene chloride), polystyrene, styrene-acrylonitrile copolymer and polyester. Actual printing stocks and coated papers can also be used.

[0296] Substrates containing minute voids are preferred since image quality improves. Such substrates can be prepared by, for example, blending a thermoplastic resin with a filler such as an inorganic pigment or a polymer incompatible with the thermoplastic resin, fabricating the blended product into a mono- or multi-layer film with use of a melt extruder, and elongating the film uniaxially or biaxially. The content of void is determined by selecting the resinous materials and the filler, the blending ratio thereof and the elongation conditions.

[0297] As the thermoplastic resin, polyolefin resins such as polypropylene and poly(ethylene terephthalate) resins are preferred since they crystallize well, and are readily elongated and suited for void formation. It is preferred to use a polyolefin or poly(ethylene terephthalate) resin as the main ingredient and a small quantity of another thermoplastic resin together. Inorganic pigments used as the filler preferably include those with an average particle size of 1 to 20 μm comprising calcium carbonate, clay, diatomite, titanium oxide, aluminum hydroxide and silica. An example of the incompatible polymeric material used as the filler is poly(ethylene terephthalate) for polypropylene as the thermoplastic resin. Japanese Patent Application No. 290570/1999 describes in detail substrates containing minute voids.

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When the image protective layer is provided on the image forming layer, each layer may be coated separately, and the layers may be multilayer coated by wet-on wet coating method.

In carrying out wet-on-wet multilayer coating, a combination of an extrusion coater with a reverse roll, a gravure roll, an air doctor coater, a blade coater, an air knife coater, a squeeze coater, a dip coater, a bar coater, a transfer roll coater, a kiss coater, a cast coater or a spray coater can be used.

The adhesion between upper and lower layers is enhanced, since in the multilayer coating according to the wet-on-wet method the upper layer is coated on the wet lower layer.

The calendar treatment referred to in the invention means a process in which, after the image forming layer is provided on the support, the resulting material is passed between a nip roller with 1 to 100 cm diameter having a smooth surface and a heat roller capable of being heated at a specific temperature and pressure, whereby voids in the image forming layer, which occur in the coating and drying steps, are reduced to obtain a high density image forming layer.

The line pressure of the nip roller is ordinarily 2 to 100 kg/cm, preferably 5 to 50 kg/cm in order to reduce voids of the image forming layer. The temperature applied is ordinarily 40° to 200° C., preferably 50° to 120° C., but since the temperature varies due to a transporting speed, the optimal temperature is set to give a maximum temperature elevating speed of 30° to 100° C. in the image forming layer during calendar treatment. The calendar treatment is preferably carried out after coating of the image forming layer.

FIG. 1(A) is one preferable embodiment of the image forming material of the invention which comprises an image forming layer 2 and an image protective layer 4 containing fine particles provided on a support 1 in that order and an image receiving layer 3 adjacent to the image protective layer 4. FIG. 1(B) is another preferable embodiment of the image forming material of the invention which comprises an image forming layer 2 and an image protective layer 5 containing fine particles provided on a support 1 in that order, some particles 7 having a diameter greater than the thickness of the image protective layer 5. FIG. 1(A) magnifies FIG. (A). In the image protective layer 4 of FIG. 1(A), some particles (Number 7) protrude from the surface and other particles (Number 8) are buried in the layer. FIG. 1(B) magnifies FIG. (B). In the image protective layer 5 of FIG. 1(B), all particles (Number 7) protrude from the surface, since the particle diameter r is greater than the thickness d of the image protective layer 5. FIG. 1(C) is still another preferable embodiment of the image forming material of the invention which comprises an image forming layer 2 and an image protective layer 6 provided on a support 1 in that order, the surface of the image protective layer being roughened, and an image receiving layer 3 adjacent to the image protective layer.

<Image protective layer>>

The thickness of the image protective layer in the invention is 0.03 to 1.0 μm , and preferably 0.05 to 0.5 μm .

In the invention, the surface of the image protective layer on the image receiving material side has a smoother value of 1 to 200 mmHg, preferably 1 to 100 mmHg, at 23° C. and 55% RH. The smoother value can be adjusted by roughening the surface of the image protective layer with a sand blast method or by incorporating fine particles in the image protective layer. The smoother value is obtained by measuring the surface using a smoother SM-6B produced by Toei Denki Kogyo Co., Ltd.

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One embodiment of the image protective layer in the invention is comprised essentially of a binder and fine particles.

The resin for the binder can be used without any limitation, as long as it can carry the fine particles. The binder resin includes polyurethane, polyester, vinyl chloride resins such as vinyl chloride copolymers and vinyl chloride-vinyl acetate copolymers, polyolefins such as butadiene-acrylonitrile copolymers, polyvinyl acetals such as polyvinyl butyral, cellulose derivatives including nitrocellulose, styrene resins such as styrene-butadiene copolymers, acrylic resins such as polymethyl methacrylates, polyamide resins, phenolic resins, epoxy resins, phenoxy resins, and water soluble resins such as polyvinyl alcohol and gelatin. The resin binders can be used singly or in combination.

The resin has a glass transition temperature of preferably 80° to 200° C. Such a resin includes polyester resins such as Eliter UE3690 produced by Unichika Co., Ltd. and acrylic resins such as Dianar BR-50, BR-52, BR-73, BR-75, BR-77, BR-80, BR-82, BR-83, BR-85, BR-87, BR-88, BR-95, BR-100, BR-108 produced by Mitsubishi Rayon Co., Ltd., polyurethane such as Bilon-1400 produced by Toyo Boseki Co., Ltd., phenoxy resins such as PKHC, PKHH and PKHJ produced by Union Carbide Co., Ltd. and Phenoloto YP-50, YP-50S produced by Toto Kasei Co., Ltd., and polyvinyl acetal resins such as Eslec KS-1, KS-5, BX-1, BX-2, BX-5 and BX-55 produced by Sekisui Kagaku Kogyo Co., Ltd. The resin with a transition temperature lower than 80° C. may result in the low resolving power and the resin with a transition temperature over 200° C. results in lowering of its solubility to a solvent.

The image protective layer in the invention is preferably hardened with a hardener.

The binder resin of the image protective layer preferably has a functional group capable of being hardened with a hardener. For example, when the image protective layer contains an isocyanate compound as a hardener, the resin has preferably a hydroxy group, and when the image protective layer contains an amine compound as a cross-linking agent, the resin has preferably an epoxy.

The content of the binder resin in the image protective layer is 10 to 99.5% by weight, and preferably 40 to 98% by weight.

The image protective layer preferably contains a hardener such as a polyisocyanate in order to enhance its durability.

When the image protective layer is hardened, the binder resin of the image protective layer has a functional group capable of reacting with a hardener and cross-linking. For example, when the hardener is an isocyanate compound, a phenoxy, cellulose, polyvinyl acetal, acrylic or urethane resin, a polyvinyl chloride resin or a polyester resin is preferably used.

In the invention, when the image protective layer is coated on the image forming layer, at least one of solvents used in the image forming layer coating solution is preferably the same as one of solvents used in the image protective layer coating solution in view of durability of the image forming material. The solvents include alcohols (ethanol, propanol), cellosolves (methyl cellosolve, ethyl cellosolve), aromatic solvents (toluene, xylene, chlorobenzene), ketones (acetone, methyl ethyl ketone), esters (ethyl acetate, butyl acetate), ethers (tetrahydrofuran, dioxane), halogenated solvents (chloroform, dichlorobenzene), and amide type solvents (dimethylformamide, N-methylpyrrolidone).

When the image protective layer is provided on the image forming layer hardened by hardening the binder with a hardener, the resulting material is preferable in view of improved resolving power and anti-scratching property.